REMARKS

Initially, applicant would like to thank the Examiner for the helpful and courteous personal interview she conducted with applicant's undersigned representative on 4 May 2006. During said interview, the merits of the claimed invention (primarily claims 73, 79 and 80) were discussed in comparison to the art of record, including a discussion of key differences between the claimed invention and the prior methods of one of the inventors (Dr. Akedo), involving internal strain of material particles used in forming the composite structure and resulting crystal orientation reflected in the displacement of the major peaks being 30% or less. No particular agreement was reached, however.

Upon entry of the present Amendment the claims in the application are claims 5, 74, 78-94, and 98-114, of which claims 79, 80, and 81 are independent. No additional claim fees are believed to be required as applicant has previously paid for 57 total claims and 6 independent claims. Please note that divisional applications have filed relating to apparatus claims 44-56 and particle claims 95-97 which have been subject to restriction requirement, withdraw from consideration and cancelled from this application.

Claim 5 is amended to depend from claim 79, and claims 74, 78 are amended to depend from claim 5.

Claim 79 is amended to more clearly define that, "…when crystals forming the structure are measured by X-ray diffraction, displacement of <u>the intensity ratio of three peaks of</u> four major peaks <u>of X-ray diffraction data excluding the highest peak</u> is 30% or less in a case where results of the integrated intensity calculation of the <u>three</u> peaks are shown by an intensity ratio <u>where the integrated intensity calculation of the highest peak is 100</u> and <u>the intensity ratio of</u> JCPDS (ASTM) data of the brittle material is set as a reference …", while similarly Claim 80 is

amended to more clearly define that, "…when crystals forming the structure are measured by X-ray diffraction, displacement of <u>the intensity ratio of three peaks of</u> four major peaks <u>of X-ray diffraction data excluding the highest peak</u> is 30% or less in a case where results of the integrated intensity calculation of the <u>three</u> peaks are shown by an intensity ratio <u>where the integrated intensity calculation of the highest peak is 100</u> and results for raw powder are measured by a thin coat optical system are set as a reference of a non-orientation state…."

New claim 112 presents the same feature as claim 5, but depends from claim 80, while new claims 113 and 114 correspond to claims 74, 78, but depend from claim 112.

New claims 112-114 are directed to the invention Group I previously elected by applicant in response to the restriction requirement previously imposed by the Examiner.

The specification has been amended to provide an express antecedent basis for the amended language of claims 79, 80, to correct two minor errors/inconsistencies in the discussion of the value "{hkl} = {<u>121</u>} is 100" from Tables 1 and 2, and to also add a discussion of the disclosed shredders as "disintegrating machines".

Applicant respectfully submits that all of the above amendments are fully supported by the original application, including the original claims, the discussion of the twelfth embodiments discussed at pages 35-36 of the original specification, including Tables 1 and 2, and the disclosure of the several embodiments of the shredders. Applicant also respectfully submits that no new matter is added by the amendments.

<u>Art-Based Rejections</u>

1. In Item of the Office Action, **the Examiner has rejected claims 1-5, 10, 73-74, and 78-80 under 35 USC 102(e) as being anticipated by Akedo et al., U.S. Patent No. 6,280,802 (Akedo '802)**. It is the Examiner's belief that Akedo '802 discloses a substantially identical

structure as the structure recited in applicant's claims and, therefore, the physical properties of presumed to be inherent and consequently identical.

Further, the Examiner states that: the requirements of applicant's claim 73 are met because Akedo et al. disclose production of a film having a particle size range from 10nm - 5 μm, (column 2, line 50, and a density (compactness) of not less than 95%, (col. 13, line 1); and that the limitations of claims 79-80 are met, e.g., the displacement of four major peaks is 30% or less, because these characteristics are inherently present in the prior art.

2. In Item 7 of the Office Action, **the Examiner has rejected claims 1-4, 10, 73-74, 78-80 and 98-111 under 102(e) as being anticipated by U.S. Patent No. 6,531,187 (Akedo '187)**. The Examiner's position is substantially the same as that in the above rejection based on Akedo '802.

3. In Item 9 of the above-identified Office Action, **the Examiner rejected claims 8-9 and 75-77 under 35 USC 103(a) as being unpatentable over Akedo '802**. The Examiner states Akedo '802 discloses that if the particles to be deposited are oxide materials using air, oxygen, or other oxidizing agent, the oxygen deficiency in the oxides could be controlled, however, no aspect ratio of the crystals is disclosed. The Examiner further stated that if the deficiency can be controlled, it would be obvious to modify the amount of oxygen in order to generate a film with improved characteristics. The Examiner also stated that it would be obvious to modify the size of the particles and thus the aspect ratio in order to have a particle size which is not fused.

<u>Applicant's Response</u>

Upon careful consideration applicant respectfully traverses each of the above rejections, and submits that each of the present claims, including independent claims 79 and 80 are clearly

patentably distinct over the Akedo '802 and Akedo '187 references, based on the following.

A. Initially, applicant notes that the US filing date of the Akedo '187 patent, 29 March 2000, is subsequent to the earliest priority date claimed by the present application, i.e., 12 October 1999 based on Japanese patent application 11-289904 (JP '904). Additionally, applicant encloses herewith an English language translation of JP '904, to thereby perfect applicant's claim for priority from JP '904 under 37 CFR 1.55. Thus, it is respectfully submitted that Akedo '187 is not "prior art" to the present application and that the rejection based on this reference should be reconsidered and withdrawn.

B. With respect to claims 79-80, applicant respectfully submits that while Akedo '187 and Akedo '802 generally disclose aerosol (or gas) deposition methods for depositing ceramic particles, and resulting films/bodies, similar to those presented in the present application, the composite structure defined by claims 79-80 is significantly different than the structure bodies disclosed/achieved by Dr. Akedo's prior methods because the structures of the Akedo references exhibit crystal orientation, contrary to the requirements of claims 79-80, as reflected in the amount of displacement in the major peaks. As discussed during the recent interview, the experimental results presented below reflect displacement of the major peaks in a sample according to the claimed invention and displacement of the major peaks in samples prepared according to the prior methods of Dr. Akedo.

The article "DEPOSITION METHOD USING ULTRAFINE PARTICLE BEAM AND ITS APPLICATIONS", which was previously submitted and also written by one of the inventors of References 1 and 2, Dr. Jun Akedo, and published around the same time as Akedo '802, shows that the polycrystalline structure of the prior art materials has crystal orientation. FIGS. 4-6 of the article show XRD patterns of PZT, NiZn ferrite, and TiO_2, respectively. Incidentally,

Akedo '802 and Akedo '187 each disclose examples using PZT or TiO_2 in forming structure bodies.

Following are results of the integrated intensity calculation obtained from the XRD patterns of the present invention and the above-mentioned article based on the deviation of the integrated intensity defined in the present invention, and Exhibit C hereto explains the calculation:

(a) Integrated intensity of the alumina structure described in the present invention

1) Deviation of integrated intensity with reference to JCPDS card 74-1081

Main peak	1	2	3	4
(hkl)	(121)	(120)	(110)	(132)
Deviation of integrated intensity	-	15.3%	10.8%	5.7%

2) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4
(hkl)	(121)	(120)	(110)	(132)
Deviation of integrated Intensity	-	4.7%	10.8%	8.2%

Each of the deviations of the integrated intensity is less than 30%.

(b) Integrated intensity of NiZn ferrite described in relation to FIG. 5 of the Article (corresponding to Akedo '802)

3) Deviation of integrated intensity with reference to JCPDS card 8-234

Main peak	1	2	3	4
(hkl)	(311)	(220)	(440)	(511)
Deviation of integrated Intensity	-	62.2%	181.9%	72.7%

4) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4
(hkl)	(121)	(440)	(511)	(400)
Deviation of integrated Intensity	-	99.1%	53.3%	579.8%

The deviation of the integrated intensity exceeds 30% for each of the three major peaks in each sample (noting that the peak 1 is the reference or standard). Since the deviation of the

integrated intensity exceeds 30% in at least one of the three major peaks, it can be said that the structure has “crystal orientation”.

(c) Integrated intensity of PZT described in relation to FIG. 4 of the Article (corresponding to Akedo ‘802)

5) Deviation of integrated intensity with reference to JCPDS card 33-784

Main peak	1	2	3	4	
(hkl)	(110)	(211)	(200)	(111)	
Deviation of integrated Intensity		-	67.6%	60.3%	25.3%

6) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4	
(hkl)	(110)	(211)	(111)	(100)	
Deviation of integrated Intensity		-	12.0%	39.2%	11.4%

The deviation of the integrated intensity exceeds 30% in two of the three major peaks under 5) and one of the three major peaks under 6). Since the deviation of the integrated intensity exceeds 30% in at least one of the three major peaks, it can be said that the structure has “crystal orientation”.

(d) Integrated intensity of TiO_2 described in relation to FIG. 6 of the Article (corresponding to Akedo ‘802)

7) Deviation of integrated intensity with reference to JCPDS card 21-1272

Main peak	1	2	3	4	
(hkl)	(101)	(200)	(105)	(004)	
Deviation of integrated Intensity		-	48.3%	9.4%	39.9%

8) Deviation of integrated intensity with reference to raw fine particles

Main peak	1	2	3	4	
(hkl)	(101)	(200)	(105)	(004)	
Deviation of integrated Intensity		-	54.5%	11.6%	41.9%

The deviation of the integrated intensity exceeds 30% for two of the three major peaks in each of 7) and 8). Since the deviation of the integrated intensity exceeds 30% in at least one of the three major peaks, it can be said that the structure has “crystal orientation”.

As reflected in the above data, the present inventors have determined that a structure

having crystal orientation was formed at the time of the Akedo ‘802 and Akedo ‘187 when practicing the methods taught in these references. The present inventors consider (have determined) that the deviation of the integrated intensity is 30% or less for all of the three major peaks in the structure having no substantial crystal orientation.

The above results are, of course, consistent with the disadvantages associated with Japanese Unexamined Patent Publication No. 2000-212766 (JP ‘766) as discussed in Background of the present application, e.g., undesirably results in a composite structure with insufficient peel strength and non-uniform density. Please note that Akedo ‘802 corresponds to JP ‘766.

In this regard, applicant acknowledges the Examiner’s indication during the recent interview that her rejection of claims 79, 80 was based on her understanding that the claims only required the deviation of the integrated intensity be equal to or less than 30% for at least one of the major peaks, rather than for all of the major peaks. Again, however, the claim language requires all of the three major peaks to meet the discussed limitation, and is more clearly defined in the above amendments to these claims.

In the composite structure according to the present invention, a polycrystalline structure made of a brittle material is formed on a surface of a substrate using at least one of a brittle ceramic and a brittle metalloid. A primary distinguishing feature of the present invention is in that the polycrystalline structure substantially has no crystal orientation, or in other words is randomly oriented. In this point, the present invention is different from the methods and materials of Akedo ‘802, Akedo ‘187 and the Akedo article.

The technical conception of the present invention that a structure having no crystal orientation is formed is achieved by actively causing fine particles to be fractured at random

when a brittle material structure is formed. According to a method embodiment of the present invention, the brittle material fine particles are caused to collide with a surface of a substrate, and the fine particles are fractured or deformed by the impact, so as to form a structure made of a fine particle material.

Generally, since brittle material fine particles have a crystal face of various bonding energy, there are some cases where fracture or deformation easily occurs and other cases where it hardly ever occurs depending on the direction of the collision with the substrate and the direction of the crystal face impacting with the substrate. Therefore, if a structure is formed only by causing brittle material fine particles to collide with a substrate, the particles which fracture may tend to have similar crystal face structures and similar bonding energy, which causes the formed structure to have orientation. On the other hand, when the fine particles are not fractured or deformed due to the relative angle between the collision direction and the crystal face, this causes the fine particles to bounce back and the formation speed – efficiency to be low, and it has been impractical-impossible to achieve a sufficiently thick film over a wide area of a substrate with these methods.

In order to solve these limitations, the present invention actively causes fine particles to be fractured at random, so that fracture or deformation is not affected by the crystal face of the fine particles. With this, the formation speed can be improved, and a structure having substantially no crystal orientation can be formed. For example, it is explained in the present specification that according to an embodiment of the invention the ceramic particles may be pre-processed via milling over a period of time to increase the level of internal strain significantly, thus leading to a relatively high percentage of ceramic particles fracturing upon impact with the substrate, permitting a high deposition rate over a wide area of the substrate. Such high

deposition rate makes it possible to achieve a sufficiently thick film over a wide area of a substrate in a practical manner.

The above distinctions may be further understood with reference to Exhibit A attached hereto, including electron microscopic photographs of raw particles and milled particles with increased levels of internal strain, a chart of film thickness achieved over 20 minutes using particles with different levels of internal strain, a graphic representation of deposition according to the prior methods of Akedo in comparison to the present invention, etc., and with reference to Exhibit B attached hereto, which includes two microphotographs of a composite structure formed according to the invention, and one photograph of a glass plate (approximately 1-2 feet square) having a composite structure according to the invention (the central translucent/hazy area) formed over a large percentage of one surface thereof.

In this regard, and as discussed during the recent interview, an owner-assignee of the invention, Toto, Ltd., is currently pursuing business relations for exploitation of the technology which it has shown to be practically possible.

Based on the foregoing, the rejections based on the Akedo '802 and Akedo '187 references are believed to be overcome in relation to present claims 5, 74, 78-94, and 98-111 are believed to be overcome, and it is respectfully requested that the rejections be reconsidered and withdrawn.

Other Matters

New claims 112-114 are believed to be allowable based on the foregoing arguments regarding claims 79, 80, as well as on the additional features set forth in the new claims.

CONCLUSION

For all of the above mentioned reasons, applicant requests reconsideration and withdrawal of the rejections of record, and allowance of all the pending claims. The application is believed to be in condition for allowance, and a Notice to this effect is earnestly solicited.

If the Examiner is not fully convinced of the allowability all of the claims now in the application, applicant respectfully requests that the Examiner telephonically contact applicant's undersigned representative to expeditiously resolve prosecution of the application.

An RCE and a Petition for a Two Month Extension of Time are being filed concurrently herewith.

Favorable consideration is respectfully requested.

Respectfully submitted,

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